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APPENDIX A

The Tier III Coalition for Wireless E911

List of Constituent Carriers

The Tier III Coalition for Wireless E911

Constituent Carriers

Cal-One Cellular L.P.

California RSA #3 Limited Partnership. A California Limited Partnership d/b/a Golden State Cellular

El Dorado Cellular, A California Corporation d/b/a Mountain Cellular

Illinois Valley Cellular RSA 2-I Paitnership d/b/a Illinois Valley Cellular

Illinois Valley Cellular RSA 2-U Partnership d/b/a Illinois Valley Cellular

Illinois Valley Cellular RSA 2-III Partnership d/b/a Illinois Valley Cellular

Iowa RSA No. 2 Limited Parmei-ship d/b/a Lyrix Wireless

Minnesota Southern Cellular Telephone Company d/b/a HickoryTech Wireless

Missouri RSA No. 7 Limited Partnership d/b/a Mid-Missouri Cellular

Northwest Missouri Cellular Limited Partnership

Public Service Cellular, Inc.

RSA 1 Limited Partnership d/b/a Cellular 29 Plus

B

APPENDIX B

Ex Parte Filing Made By TruePosition, lnc.

Dated July 24. 2000

EX PARTE OR LATE FILED

WILLKIE FARR & GALLAGHER

EX PARTE

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

July 24, 2000

Ms Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, S W
12th Street Lobby, TW-A325
Washington. DC 20554

Re: Ex Parte Presentation in CC Docket No. 94-102

Dear Ms. Salas:

We are writing on behalf of TruePosition, Inc. to provide further information about TruePosition's ability to provide wireless location services in rural areas and the testing methodology TruePosition employs to measure the accuracy of its network-based location technology This information should prove useful in light of recent discussions we have had with the staff of the Wireless Telecommunications Bureau concerning TruePosition's field trials and other testing of its technology.

Since late 1996, TruePosition has deployed its receivers in over 300 cell sites in a variety of environments including dense urban, suburban, rural, and over water. To date. these systems have been implemented for AMPS, TDMA, and CDMA networks in the cellular (850 MHz) band. TruePosition believes that its system is capable of meeting the current FCC mandate of 100 meters for 67 percent of wireless 911 calls for each of these air interfaces and for each of these environments. However, for each carrier's network, satisfying the Commission's location requirements will come at different costs. Reasons for these differences include, among other things. the transmission bandwidth.' the transmission length of the control channel,[2] and the

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AMPS and TDMA transmissions have a transmission bandwidth of less than 30 KHz, while CDMA has a transmission bandwidth of 1.22MHz. TruePosition's ability to detect and resolve multipath errors is partially a function of transmission bandwidth.

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transmitted power of the control and voice channels' -- each of which varies depending upon the air interface the carrier has selected.

It is apparent that rural areas present unique challenges to providing wireless location-based services Wireless networks are typically constructed using cell sites separated by 1000 to 3000 feet in urban areas. 3 to 10 miles in suburban areas, and 10 to **30 miles** in rural areas. While attenuation due to propagation is greater in urban areas and much less in rural areas, there are frequently many fewer cell sites available for location processing in rural areas than urban areas. In addition. cell sites in rural areas are frequently in a linear "string-of-pearls" geometry. Thus, it is highly unlikely that network-based technologies in rural areas can satisfy the Commission's existing accuracy requirements for wireless E911 unless carriers are required to undertake very substantial expenditures for this purpose. At this time. however, TruePosition is confident that it can deploy its location technologies today in rural areas without requiring unreasonable expenditures by carriers and that the accuracy of this location technology will advance the Commission's **goals** in this proceeding.

By extrapolating the data from field tests and laboratory testing of its location technologies, TruePosition has determined that its technologies can meet a **250** meter accuracy standard in rural areas without requiring camers to expend significantly more resources to construct additional facilities This calculation is applicable to all existing **CMRS** transmission standards. While this 250 meter calculation does not satisfy the Commission's existing requirement, we believe that it would prove sufficient to bring substantial benefits to wireless subscribers living and traveling in rural areas

When designing a location network for a rural area, TruePosition and the wireless camer *must* consider the following choices: (1) whether the design can be accomplished using only the carrier's existing cell sites; *(2)* whether the design can be accomplished using only the carrier's existing antennas deployed at the existing cell sites; **(3)** whether the design can **be** accomplished

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The transmission length of an AMPS control channel is approximately 100 **ms,** a **TDMA** control channel is approximately 13.4 to **21.2** ms. and a CDMA control channel is approximately 160 ms. Transmission **lengths** can be up to several seconds for the purpose of integration for location processing. Location accuracy is enhanced by longer transmission times.

The transmitted power for AMPS and TDMA control channels is typically 100 to 600 mW, and voice channel **power** is typically 6 to 600 mW. CDMA *control and* voice channel power is typically <1 microwatts to *6* mW. Over the last **2** years, the transmitted power has been gradually reduced in order to increase capacity. TruePosition's ability to locate accurately and to detect and resolve multipath errors is partially a function of transmitted power.

using TDOA-only or whether a combination of TDOA/AOA must be deployed (the use of AOA to meet a design criteria requires use of specialized antennas not typically utilized for communications); **(4)** whether the design can be accomplished using transmission length and transmission power settings that the carrier has chosen for quality communications.

Each of these design choices will have an impact on the cost of the system design. **As** previously presented, TruePosition believes that its system can meet the current **FCC** accuracy criteria in all cases, however, the design implications of the FCC criteria in rural areas can require carrier expenditures on additional cell sites, additional antennas, increased use of AOA, or changes in the transmission power/length settings. Given the large investment in capital deployments by the wireless industry recently. wireless carriers have been reluctant to make substantial new investments. especially in rural areas where the greatest modifications may be required to comply with the 100 meter, 67 percent criteria.

On the other hand. the FCC could encourage more rapid deployment of location systems in rural areas by providing flexible deployment standards that are based upon the carrier's existing choices of cell site locations, cell site antennas. etc. TruePosition believes that in pure I-to-I overlay scenarios, where TruePosition receivers are connected only to existing antennas at existing cell sites, system accuracy of **250** meters (67%) in rural environments can be readily achieved. **A** pure I-to-I overlay scenario is generally the least cost and fastest means to a deployment of location services. In order to improve the accuracy in rural areas, more sophisticated and more costly design approaches would be required.

In the future, the natural development of CMRS networks will lead to improvements in location accuracy. For example, the number of cell sites nationwide continues to grow dramatically. This increases cell site density which directly affects location processing. Moreover, rural cell sites are gradually being converted from omnidirectional antennas to sectored antennas. This increases the gain of the antennas in rural areas and can increase the number of cell sites available for location processing. The evolution of wireless phones to support ***3G*** standards will increase the transmission bandwidth and will also have a very positive impact on location accuracy. Finally, commercial location services, which are non-existent today, are forecast to grow rapidly. The Commission can expect investment will follow market opportunity and there will be increased willingness over time to implement more sophisticated designs.

In addition, TruePosition would like to further explain its methodology for field testing its location technologies. Pursuant to the terms of OET Bulletin No. 71, TruePosition has adopted a testing methodology that is based on actual E911 call location information and **is** weighted to those areas where more calls are made.[4] **As** described in previous filings, TruePosition's testing methodology **is** designed *to mimic* wireless 911 call *scenarios.* Therefore, TruePosition **uses**

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[4] Guidelines for Testing and Verifying the Accuracy of Wireless E911 Location Systems, OET Bulletin No. 71 (rel. March 31, 2000).

standard handheld and mobile wireless phones which have not been modified in any manner (neither hardware nor software modifications) These phones are then used to place test calls in both in-vehicle and walking scenarios, and the calls are placed in sufficient quantities and from a sufficiently large number of places to assure a reasonable statistical sample. In determining the cross section of places from which to place test calls. TruePosition uses the existing distribution of wireless 911 calls as a guide.

Generally, TruePosition and the wireless carrier with whom it is testing will agree upon the number of test points to be used as well as the coverage area of the test points. The test points are typically laid out in a grid pattern, with the actual pattern varying depending upon the terrain. roads and highways, and cell site density. Test points may be as close of 1/10 of a mile in dense areas and as far as **2** miles apart in rural areas Cell site density is a good proxy for subscriber and call density. therefore test point density will increase with cell site density. The wireless 911 call patterns can be easily determined from the TruePosition system itself as well as by anecdotal evidence from local PSAPs. (Even prior to optimization. the TruePosition system is sufficiently accurate to capture all 911 calls and approximately locate them. Simple plotting on electronic maps rapidly reveals 911 calls patterns.)

After density and spacing have been determined, the test points are then distributed according to logical test routes that can be repeatedly driven over a period of a few weeks. For example. a driver will be given a map for which a particular route has been highlighted. On the route, specific points are explicitly identified (i.e. the tire hydrant at the S E. comer of 5th and Main Streets. or mile marker 38 2 westbound on I-80). The same test points are used for each drive test, and ground truth is predetermined using differential GPS for each test point. Each test point is given a dialing code so that each call can be associated with a test point. Using this method, a drive tester will stop at each test point in sequence, and may dial *1001 at the first test point. * I002 at the second test point. * 1003 at the third test point. and so on. **A** reasonable statistical sample is created by placing 10 to 20 calls at each test point. The TruePosition system will locate each call, resulting in a latitude/longitude determination that is later compared to the stored ground truth for the test point associated with the dialed digits.

TruePosition **uses** a database program that then combines all of the test calls, the accuracy associated with each test call. and a weighting that corresponds to existing **wireless** 911 call patterns. Statistics can be computed for each test point or for the entire system. Data can be separately reported for analog calls and digital calls. In a 100 cell site system covering a typical average market, we would adopt 100 to 200 test points, and conduct 1000 to 3000 test calls per day for several days.

We hope you find this information useful in your deliberations. If you have any questions. please do not hesitate to contact us

Respectfully submitted,

Philip L Verveer
David M. Don

cc Rob Eckert
Pat Forster
Dan Grosh
Bill Lane
Marty Liebman
Ron Netro
Jim Schlichting
Blaise Scinto
Tom Stanley
Tom Sugrue

C

APPENDIX C

Missouri **RSA** No. 7 Limited Partnership d/b/a Mid-Missouri Cellular
Letter Requesting Withdrawal of Ray County E911 Phase II Request
Dated October 14, *2002*

KURTIS & ASSOCIATES, P.C.

SUITE 200
1000 POTOMAC STREET, N.W
WASHINGTON, D.C. 20007

(202) 328-4500
TELECOPIER (202) 328-1231

October Id. 2002

Via Facsimile and First Class US Mail

Ms Saralyn Dory
Mid-America Regional Council
600 Broadway, Suite 300
Kansas City, Missouri 64105-1554

Re: Mid-Missouri Cellular E911 Phase II Request

Dear Ms. Dot?:

This firm serves as special counsel to Missouri RSA No. 7 Limited Partnership dba Mid-Missouri Cellular ("MMC") with respect to matters before the Federal Communications Commission ("FCC"). In that capacity, I participated in a conference call last week with Mr. Greg Ballentine and you from the Mid-America Regional Council ("MARC") and Ms. Kathie Zentgraf of MMC regarding your October 8, 2002 request for MMC to provide E911 Phase I and Phase II service in Ray County, Missouri.

From those discussions, we understand that MARC *is* a regional council that is providing consolidated coordination for E911 services for the greater Kansas City metropolitan area. Ray County is a part of that area. Indeed, with the exception of MMC, we believe that all other commercial mobile radio service ("CMRS") providers that are licensed to provide service in Ray County, are also licensed to provide service throughout the greater Kansas City metropolitan area.

In sharp contrast, MMC operates a rural-only network and is not licensed to provide CMRS *to* any other part of the greater Kansas City metropolitan area. Specifically, the MMC network operates exciusively in Lafayette, Saline, Howard, Cooper, Pettis, Johnson and Ray Counties in Missouri.[1] MMC has a subscriber base of approximately 100 customers in Ray County.

[1] It should be noted that MMC is also licensed to serve a small portion of Cass County, Missouri. However, that geographic area actually receives CMRS as a part of the Cingular Wireless network, under contract between MMC and Cingular. Accordingly, E9L I calls in that area are handled by the Cingular network and nor the MMC network.

The MMC network presently operates using a TDMA digital protocol. That technology was deployed in order to maintain compatibility with MMC's then-major roaming partner, Cingular Wireless (fka Southwestern Bell Wireless). Cingular and AT&T were, by far, the two largest carriers utilizing the TDMA protocol.

Approximately 18 months ago, both Cingular and AT&T announced that they would be migrating away from the TDMA protocol. As a result, all major nerwork and handset equipment vendors announced a discontinuation of development of new features andhardware for that protocol. Unfortunately, that included the plans to develop an automatic location identifier ("ALI") handset based on the TDMA protocol. Accordingly. the only means with which a TDMA network can provide E911 Phase II service is through a network-based technology.

Vetwork-based location systems pin-point the subscriber by using received signals from multiple antenna sites in order to triangulate on the physical position ofthesubscriber. The accuracy of rhese networks increases as the number of antennas per cell site and the number of cell sites providing service to a given area increase. The MMC Ray County facilities are presently limited to two omni-directional cell sites. Indeed. the entire MMC nerworkis comprised exclusively of omni-directional cell sites with minimal overlap in coverage: sufficient to provide CMRS service but not sufficient to allow triangulation of a mobile position using a network-based E911 solution. Accordingly. MMC has yet to be able to find an E911 network-based solution vendor that will commit to meeting the FCC's accuracy requirements in this type of rural environment. Accordingly, the only E911 Phase II technology currently available to meet the FCC accuracy requirements appears to be a handset-based solution. With the unavailability of TDMA handsets. the use of a handset-based solution will require the replacement of the entire MMC digital network with a new digital protocol for which ALI handsets will be available.

MMC has been actively pursing this alternative. Unfortunately, the cost *to* migrate the MMC network would be approximately $3 million. Significantly, as of rhis point in time, Ray County is the ***only*** PSAP request which MMC has received for E911 Phase II service. However. because of the large expenditures needed to migrate the MMC switching center in order to be able to host the alternate digital technology. the cost to migrate only the two Ray County cell sites would still approach $2 million. MMC would therefore be facing a capital expenditure of nearly $20,000 ***per Ray County subscriber*** to implement the alternative digital technology in Ray County only. Moreover. since this Functionality *is* embedded in the handset, Ray County subscribers would need to be provided with handsets which were incompatible with the rest of the MMC network in order io utilize the E911 Phase II location capabilities of the system within Ray County.

MMC is categorized as a Tier III camer by the FCC.[2] As such. it is obligated to provide E911 Phase II service to 50% of its coverage area within the PSAP's service area by September I, 3003 and 100% of the PSAP's service area by September 1. 2004. However. there is no obligation on the part of the camer to replace existing non-ALI capable handsets with new handsets. Rather. the carrier's obligation is only to begin selling ALI-capable handsets by September 1 2003, and to ensure that all new handset sales are ALI-capable by November 30,2004. Tier III camers have until December 31. 2005 in which to ensure 95% penetration of its subscriber base wirh ALI-capabie handsets.

In light of the Foregoing,MMC respectfully submits that there wouldbe little practical benefit realized from seeking to require MMC to implement Phase II capabilities in Ray County at this time. Accordingly, MMC requests that MARC withdraw its request that MMC proceed at this time to be E911 Phase II compliant. in favor of allowing MMC to work with MARC as well as the other PSAPs serving the remaining counties in the MMC coverage area, to enable MMC to delay the deployment of E911 Phase II capabilities until the PSAPs serving the balance of the MMC counties are ready to also support that service. While the cost of implementing E911 Phase II will still be substantial, at that point in rime MMC will at least be able to spread those costs across its entire subscriber base and ensure that the entire MMC network remains compatible from a digital protocol standpoint. Moreover. MMC understands that next generation network-based solutions are presently in development which promise to increase the accuracy achievable in a rural environment. If that level of accuracy proves able to satisfy FCC requirements. then MMC would be able to provide E911 Phase II service from anetwork-based platform that would be not only significantly less expensive to deploy, but would have the advantage of making this important service immediately available to all subscribers and roamers. and not just those who replace their handsets.

Since the MMC network is not a part of a the greater Kansas City metropoli tan area rhat the MARC E911 network is designed to serve. and since MMC serves such a small subscriber base in only one of the counties involved in the MARC network. we respectfully request that MARC fully consider the impact of its request *on* MMC in light of the reality that handset deployment rules will. in fact, make the date by which meaningful E911 Phase II service would be available, much further into the future than the date which the current MARC request would trigger for the network to be made E911 Phase II capable.

The second part of your letter deals with the decision to place the MARC selective router in Lenexa, Kansas, asouthwestem *suburb of* Kansas City (Ray County is far northeast of Kansas City). While this location no doubt makes economic sense lor MARC and is. most likely, economically neutral to the Kansas City based *CMRS* carriers included in the MARC E911 area. as a rural-only carrier based in Sedalia. Missouri. asking MMC *to install* and *maintain* facilities to that selective router location is extremely burdensome for MMC. Significantly, ***all*** MMC E911 calls to the MARC

[2] *Order to Stay*, in CC Docket No. 94-102 (Rel. July 26. 2002) at paragraph 23

network will be destined for the Ray County PSAP. Accordinglv. the purpose behind sending the calls to the selective router to determine the appropriate PSAP to which to route the call. is unnecessary in this circumstance and requiring MMC to do so would place a substantial burden on MMC

In order to quantify the impact on MMC, MMC has obtained price quotes for dedicated T1 facilities to route from the MMC network to both the Lenexa, KS selective router and the Ray County PSAP. The recurring monthly price quoted by Southwestern Bell Telephone for the circuit to Lenexa is $1.727.00 as compared to a monthly recurring cost of $365.00 for a dedicated T1 to the Rav County PSAP. The ***difference*** between these circuit costs on an annual basis is $16,344.

In light of the foregoing, MMC requests that it be allowed to route its E911 traffic directly to the PSAP location. Since all of the traffic sent to the selective router by MMC wouldbe destined for the Rav County PSAP anyway, this would appear to be a reasonable request. If. however. there was some internal reason that MARC wanted the calls to be routed to the Lenexa. KS selective router. we would **ask** that MMC still be allowed to deliver the calls to the Ray County PSAP. At that iocation. the MMC inbound traffic could be added to the dedicated T1 which we understand will he maintained between that PSAP location and the Lenexa router site. From our discussions. we understandthat, from acapacity standpoint. that dedicated facility will be very lightly utilized. Since this issue relates to borh E91 I Phase I and Phase II calls. ir will need to be addressed even if MARC were to withdraw its request for E911 Phase II service from MMC at this time.

The FCC is well aware of the economic impact on small rural carriers in meeting E911 obligations. While the FCC has generally imposed obligations. such as meeting the PSAP at the selective router, the FCC has recognized that application of its general rules can impose significant burdens on individual carriers. Accordingly the FCC has stated that

> Where our rules impose a disproportionate burden on a particular carrier, the carrier may work wirh the public safety entities involved to mitigate that burden and. if necessary, may seek individual relief from the Commission. [3]

By this letter. MMC is hoping to work wirh MARC to mitigate the burdens imposed by its October 8. 2002 letter in advance of seeking formal relief from the FCC.

As a final matter. any obligation on [he CMRS camer is wholly contingent on the relevant PSAP being able to actually receive and process the E91 I Phase I and/or Phase II information. We

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[3] *Order on Reconsideration. Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems. Request of King County, Washington.* FCC 02-146. CC Docket No. 94-102. (Rel. July 24, 2002). at paragraph 18.

ask that you provide us with wntten confirmation of the ability of the Ray County PSAP to receive and process the E911 Phase I and Phase II information at this rime.

If you have any questions or require additional information with respect to this matter. please do nor hesitate to call.

Very truly yours,

Michael K. Kurtis

cc: Ms. Kathie Zentgraf

D

APPENDIX D

Declaration of James C. Egyud

Dated November 20, 2002

Engineering Declaration of James C. Egyud

During the past several years, vendors of network-based E911 Phase 2 ALI technology have issued docurnentation, both in advertising form and in FCC filings. claiming the ability of the vendors' solutions to meet the FCC's accuracy requirements for E911 Phase 2. I have reviewed much of that documentation and. in many cases, those materials include broad claims of compliance without specificity regarding the environment or the requirements placed upon the camer's cell site placement and configuration necessary to achieve such compliance. Some materials claim compliance in "rural" environments, but do not clarify that such compliance is entirely dependent upon the distance between cell sites. their geometry. their proliferation, and the amount of uplink coverage attainable with each site. I do not dispute the vendors' representations that their solutions have the capability to perform location measurements meeting the FCC's accuracy requirements. However. the ability to achieve that accuracy level is wholly dependent upon idealized antenna placement, terrain, environmental conditions, geometry, and spacing between antenna sites that permits them to do so. Vendors have not specified the maximum inter-site distances over which such accuracy is achievable, and the environments used to cnnduct the tests for which I have seen data have not been representative of the typical "real world" network deployment.

Simply stated. the network-based solutions use Time Difference of Amval (TDOA) as a core algorithm to determine thc position of a handset via triangulation. TDOA, by its very nature, requires the signal from a handset to reach not less than three (3) distinct cell sites. Clearly, the ability of a signal to reach each equipped site is dependent upon all Factors normally associated with cellular coverage, such as distance, intervening terrain and inorphology (buildings and foliage), antenna height. coverage pattern. etc. Therefore. the ability of TDOA to perform accurate measurements is entirely dependent upon a handset's location with respect to nearby cell sites. and the proximity of those cell sites to each other. Greater spacing between cell sites, such as in a rural setting, understandably reduces the overlap of coverage among those sites. Regardless of the receiver sensitivity of the TDOA equipment. which the vendors have not stated with specificity. the TDOA "link budget" will eventually be exhausted. Moreover, the placement of rural sites along a highway in a "string-of-pearls" arrangement, with enough disuance. essentially precludes more than 2 sites from overlapping with each other. If the mobile is near one site, it might not have sufficient overlap from either adjacent site. Complicating matters further, the uplink power reduction algorithms inherent to digital technologies such as TDMA and CDMA cause a reduction in the handset's signal as it approaches a site. further deteriorating the ability of a second. more distant site to receive sufficient signal from the handset.

Clearly, if the site spacing in a rural setting results in minimal overlap, due *to* the camer's coverage needs. additional TDOA-only antenna sites would be required to meet the FCC's requirements in areas where overlap is insufficient. In the case of a single-site "island". two additional antenna sites would be required.

As an alternative. where three antenna sites are unable to triangulate, the vendors offer Angle-of-Arrival **(AOA)** technology, where the carrier must place dedicated, specialized antennas at two (2) neighboring sites. The AOA antennas use multiple correlated elements that measure the phase of the arriving signal from the handset, and compare the phases to calculate position, according to the vendors. I have been advised verbally by these vendors that such antennas measure 3' x 4' in size, for an equivalent wind-loading "flat plate" area of approximately 12 square feet. By contrast, typical cellular and PCS antennas offer two (2) feet or less wind-loading area. Moreover, I have been advised that the **AOA** antennas require no less than four (4) feed lines each, whereas a standard cellular or PCS antenna requires one. Therefore, most rural cellular towers, which were designed to support only a given number of antennas and lines for coverage purposes, will not be able to support the **AOA** antennas, whose wind loading, combined with the loading of the feed lines, will be more than six (6) times that of a typical cellular antenna. Deployment of such antennas for the sole purpose of E911 accuracy would require substantial expenditures to reinforce towers (if possible), zoning approval for such antennas (which can take two years or more in some jurisdictions), and the possible need to replace towers entirely. Such actions would serve to generate no revenue for the carrier. Moreover. like TDOA, **AOA** accurncy across two sites remains entirely dependent on the spacing and morphology between those sites. This also fails to take into account that many rural cell sites are not sectorized but, instead, utilize near omni-directional antennas. The AOA antennas are directional, and I understand that two or possibly three of these panels would be required at each cell site. In those cases, the loading for the **AOA** antennas as compared to the omni-directional cellular coverage antennas *is* far greater than the six-fold increase specified above.

From my review, the materials presented by the vendors have not appeared to demonstrate the maximum path loss between sites where sufficient overlap remains to meet the FCC's requirements. Path loss is a function of the impeding factors discussed above: distance. antenna configuration, terrain and foliage attenuation, and cell geometry. More specifically, I have seen no test results applicable to most "real world" rural markets. with cell sites often separated by 15 to 30 miles or more and extensive areas served by sites in a string-of-pearls arrangement along a highway or by a single facility as an "island". Supporting test results, applicable to those "real-world' deployments, have not been presented. I have made repeated requests to Grayson and TruePosition, the most prevalent network-based technology vendors, for test data applicable to such scenarios. The vendors have not provided such data. Instead. they have directed me to the types of materials discussed above. Analysis of that documentation further supports the conclusion that there is no evidence to support a representation that any of the network-based solutions can satisfy the FCC accuracy requirements throughout a rural market, even if the network-based solution is deployed at every existing cell site in the typical rural system,

By way of example, on September 20, 2002. Grayson directed me *to ex parte* presentations that it filed with the Commission, with the most recent test data filed on October 25, 2001, and again on November 21, 2001. In this filing, Grayson presented data collected from its tests of the systems that it installed in St. Clair County, IL and

Lake County, IN. Grayson asserts in its October 25, 2001 letter that "the system tests demonstrated Phase 11-compliant accuracy in suburban, rural and highway environments."[1] I do not refute the results presented by Grayson, nor do I refute Grayson's claims regarding the ability of its solution to meet the Phase 2 accuracy requirements using the sites that it equipped for the tests. In fact, the test presentation did not contain enough engineering support (e.g., site antenna specifications. ground elevations, terrain profiles. RF coverage maps, test methodology, etc.) to permit an engineer to either scientifically support or refute those conclusory results. However, for the reasons set forth below, the test scenarios are simply not indicative of the typical "real world" rural deployment, which involves far greater site spacing, less favorable geometry, and "string-of-pearls" highway configurations where no more than two cells typically overlap with each other; conditions not included in the Grayson testbed.

The test map submitted by Grayson shows a cluster of sites at which it deployed its TDOA equipment. The map also identifies points at which test measurements were taken. The most cursory review of the map reveals that all test points were collected from *within* the penmeter of facilities equipped with TDOA. In other words, no measurements were presented from outside this penmeter or cluster. Although the presentation did not contain supporting RF parameters (e.g., antenna heights, antenna models. orientations, etc.), it is reasonable to expect a test location within the perimeter of equipped sites to have a bcttcr chance of having overlapping coverage from multiple sites than a test location outside that perimeter. In reality, a typical rural carrier operates a system where all of its sites are contained within a group of counties whose jurisdictional boundaries usually extend several miles beyond the outer perimeter of a camer's cell sites. The available test results do not clearly demonstrate whether or not 911 calls in such areas (i.e, outside the perimeter of equipped sites) will receive the FCC required accuracy levels. We can only surmise from general cellular coverage knowledge and sound engineering practice that such calls have far less of a chance of receiving the required accuracy because they will occur in areas with less overlapping coverage than calls made inside the cluster of equipped facilities. In order for the Grayson report to support its ultimate conclusion. it would require that the entire rural cellular service area be located within a penmeter of cell site locations. That, in turn. would require the deployment of cell sites constructed beyond the market boundary and wholly encircling the rural licensed area; a situation never encountered in the rural "real world."

Second, the greatest spacing between equipped sites within the test area is approximately ten (10) miles, much less than the 15 to 30 miles often encountered between facilities in a typical rural service area. Clearly, the overlap between facilities spaced 20 miles apart will be less than the overlap between facilities ten miles apart, and triangulation accuracy can be expected to decrease accordingly. Regardless of TDOA receiver sensitivity, path losses will eventually exceed the margin allotted by that equipment. In summary, the Grayson *ex parte* test data merely asserts accuracv for a cluster of equipped sites with a

[1] Notice of *Ex Pane* Meeting, CC Docket No. 94-102, filed on behalf of Grayson Wireless Division by Eliot J. Greenwald.

given geometry and density that permit such accuracy and does not support the stated conclusion that the Grayson system will meet the FCC accuracy requirements in a "real world" rural environment. All the Grayson submission actually demonstrates is that under idealized conditions, which are not representative of a "real world" full rural market deployment. the Grayson system ***ran*** meet the FCC accuracy requirements. Even the site spacing in many rural environments far exceeds the spacing used in these tests. Accordingly: it is important that the Grayson report not be assumed to demonstrate that the accuracy requirements can be met within a perimeter of actually deployed rural cell sites under any conditions having less favorable cell spacing, geometry, antenna configurations, and morphology than the idealized test bed.

In an article in the March, *2002* issue of *GPS World*. Mario Proietti of TechnoCom Corporation, a technologically neutral testing and integration firm, delivers **a** similar assessment of environmental and network design effects upon TDOA and AOA accuracy. In the article; Mr. Proietti raises concerns that issues such as multi-path interference, site density, and unfavorable geometry, particularly along rural highways, will degrade network-based performance.[2]

Grayson's *ex parte* filing and the aforementioned GPS World article merely support the theory that TDOA and AOA accuracy is potentially achievable, but is entirely dependent upon favorable site density and geometry, which may not be available in many rural cases. Therefore; meeting the Commission's accuracy requirements over a PSAP's entire area in the "real world" rural environment will involve building additional antenna sites that orherwise would not be needed, either between existing facilities or outside of the existing coverage area, and possibly outside of the carrier's market. Such sites would serve the sole purpose of meeting the FCC's E911 accuracy requirements while providing no revenue for the camer. Mr. Dale Hatfield specifically recognizes this problem in his report to the Commission filed on October 15, 2002.[3] This also raises the issue of a carrier possibly being required to provide coverage, for the sole purpose of E911 accuracy, in an area that is actually served by a neighboring camer.

In its July 24, 2000 *ex parte* presentation to the Commission, TruePosition offered a nearly identical assessment of the rural carrier's plight in reaching the mandated accuracy levels:

> ". . . there are frequently many fewer cell sites available for location processing in rural areas than urban areas. In addition, cell sites in rural areas are frequently in a linear "string-of-pearls" geometry. Thus. it is highly unlikely that network-based technologies in rural areas can satisfy the Commission's existing accuracy

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2 *GPS World*, March 2002, E911 Roundtable. Carrier Choices in Location: The System Integrator's View. by Mario Proietti. TechnoCom Corporation.

3 *A Report on Technical and Operational Issues Impacting The* ***Provision*** *of Wireless Enhanced 911 Services*. by Dale N. Hatfield. p.12. WT Docket No. 02-46.

requirements for wireless E911 unless carriers are required to undertake very substanrial expenditures for this purpose.'"

In addition to network-based technology, potential handset-based technology solutions have been developed in the industry for E911 Phase 2. The CDMA variant uses the Global Positioning System ("GPS"), combined with network assistance in the form of reference GPS measurements (Assisted GPS or "AGPS") and Advanced Forward Link Trilateration ("AFLT')),which leverages synchronized timing data inherent to all CDMA calls. AGPS/AFLT developers such as SnapTrack and QUALCOMM have offered promising theoretical support and prototypical test results pointing towards potential compliance with the Commission's accuracy requirements in many calling scenarios. However, I have yet to receive scientifically justified test results using actual consumer handsets with the integrated AGPS/AFLT solution. **As** a point of concern, it is well known that in-building and in-vehicle attenuation severely impede a traditional GPS receiver from receiving adequate satellite signal to perform an accurate positional determination. While the AGPS/AFLT developers assert that AGPS. by virtue of GPS reference assistance from the network, achieves an improved sensitivity over stand-alone units. the technology is not entirely immune to degradation from significant attenuation *of* dense morphological circumstances. Examples of such circumstances might be a heavy structure or the inside of a vehicle. compounded by steep adjoining terrain, dense foliage. and heavy cloud cover.

In areas where satellite acquisition is not sufficient, AFLT adds timing measurements that reach the handset from the CDMA base stations in the natural call process. This. of course, assumes that the handset receives sufficient signal strength from enough cell sites to be of assistance in the triangulation process. As discussed earlier, rural cell geometry and spacing will often limit the number of sites having contact with the handset, thereby reducing network AFLT assistance. According to verbal and written information provided to me, absent sufficient satellite acquisition, AFLT by itself will not yield the accuracy mandated by the Commission.[5] In his *GPS World* article, Mr. Proietti raises significant concerns that "Upgrades to the handsets are needed to achieve the location accuracy specified by E911 requirements." Mr. Proietti also alludes to expensive costs of handset-based technology deployment.[6]

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[4] *Ex Parte* Presentation *of* TruePosition. Inc. in CC Docket No. 94-102, filed on July 24. 2000, at 2.

[5] *GpsOne™ hybrid position location system*, paper by Samir Soliman, Parag Agashe. Ivan Fernandez, Alkinoos Vayanos, Peter Gaal. and Milan Oljaca: QUALCOMM, Incorporated. (field trial results, p. 6)

[6] See *Proietti*

Compounding the lack of test reports for commercial-grade handsets, Tier III rural carriers have yet to obtain ALI-capable handsets that they can independently test for accuracy. let alone offer to their subscribers. Over the past 15 months. I have made numerous verbal and written requests to the prominent handset wholesalers, from whom the Tier III carriers must purchase handsets because those camers lack the market clout to be able to test and purchase handsets directly from the manufacturers. Of the three most prominent distributors. only one responded to my inquiries with knowledge of any ALI-capable handsets. Even in that case, the distributor could not predict when ALI-capable models will become commercially available to Tier III carriers, let alone at what price or in what quantity. Once such handsets do become available in commercial quantities. a Tier III carrier should not be expected to promote that such handsets meet thc FCC's accuracy requirements without independently verified results of tests conducted by the carrier or by another party, or a guarantee by the manufacturer.

As the Commission is well aware, TDMA camers do not have a handset-based option for E911 Phase 2. Therefore, the other alternative for a TDMA camer to cover the entire area would be to perform a network-wide protocol change to CDMA or GSM, which would permit a handset-based solution, at a cost of millions of dollars. Aside from the cost of this entire system overlay, as stated above, significant questions remain as to whether the new overlaid system, using a handset-based technology, will even be able to meet the Phase II accuracy requirements in a "real world" rural environment. Even if the accuracy could be achieved, the handset-based solution would serve *only* those subscribers with the properly equipped handsets and not serve any other subscribers or roamers not so equipped.

It is apparent from the ongoing development of TDOA and AOA technology that E911 Phase II accuracy possible from network-based solutions may continue to improve. Both TruePosition and Grayson have indicated ongoing solution development in their public materials. Moreover, in the evolution of their networks. rural camers will also continue to add facilities over the coming years as required by revenue-generating market demand. Such additional sites. as discussed above, will also serve to improve upon coverage and accuracy obtainable from thc network-based solutions. TruePosition's *ex parte* filing offers chis same prediction of a growth path to higher achievable accuracy in the future as a natural outcome.[7]

In summary, forbearance from the accuracy requirements will permit the carriers in the rural areas to provide E911 service to the greatest portion of the public at the most economical cost. It will also permit the FCC to develop the well-defined, standardized compliance tests that Mr. Hatfield recommended in his report.*

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[7] *TruePosition* at 3.

[8] *Hatfield Report* at 35.

AFFIDAVIT

I. James C. Egyud, hereby declare and state as follows:

1. I am a Senior Consulting Engineer in the field of wireless telecommunications with the firm of Kurtis & Associates, P.C.;

2. I graduated from *Grove* City College. Grove City, Pennsylvania, with a degree of Bachelor of Science in Electrical Engineering in 1990;

3. I am familiar with the Federal Communications Commission's Rules and Regulations, including Part 22 and Section 20.18 regarding the provision of Enhanced 911 services;

4 I have designed cellular and PCS systems throughout the United States since 1990, and am familiar with the technical, operational, and propagation characteristics associated therewith;

5. I am familiar with the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102;

6. I am familiar with the report submitted to the FCC by Mr. Dale Hatfield on October 15, 3002, regarding "Technical and Operational Wireless E911 Issues", WT Docket No. 02-46;

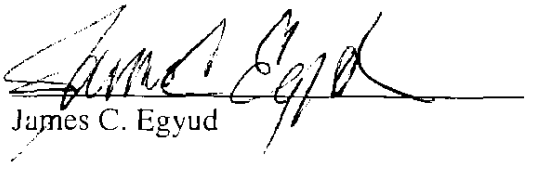
7 I am familiar with the technical options available to CMRS carriers lor the provision of Enhanced 911 services. and the current technological limitations inherent to those options:

8 Rased on my professional judgment and the experience referenced herein, I am technically qualified and responsible for the attached Declaration regarding the provision of Enhanced 911 services by "Tier III" CMRS carriers in rural areas:

9 The foregoing statements are true and correct of my own knowledge except such statements therein made on information and belief. and as to such statements, I believe them to be true;

I declare under penalty of perjury that the foregoing is true and correct

11/20/2002
Date


James C. Egyud

CERTIFICATE OF SERVICE

I, Ruth E. Garavalia. a sccrctary with the law firm of Kurtis & Associates, P.C., do hereby certify that I have this 20th day of November, 2002. had copies of the foregoing "PETITION PURSUANT TO 47 U.S.C. §160(c) FOR FORBEARANCE FROM E911 ACCURACY STANDARDS IMPOSED ON TIER III CARRIERS FOR LOCATING WIRELESS SUBSCRIBERS UNDER RULE SECTION 20.18(h)" hand delivered to the following:

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Federal Communications Commission
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